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BOTANY.—*An account of sixteenth-century agriculture on the Mexican Plateau.*[1]

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The successful development of agriculture and allied arts among the peoples of the central plateau of Mexico was quickly recognized by the Spaniards who carried the conquering arms and banners of Charles V into that new world. In spite of the conquest and the overthrow of pre-Cortesian kingdoms, the cultural elements of the ancient tribes continue to influence the practical lives of most modern Mexicans. The food plants of the native races have an unfailing interest for any enquiring mind. Moreover, the character of the post-Conquest colonization was determined in large measure by the cultural background of the native races, no less than by climatic and geographic conditions of the country.

The memoir of Tezcuco,[2] by Juan Bautista Pomar, written in 1582 has been reprinted recently and relates some matters of prime importance concerning the agriculture of that kingdom. The author was a mestizo, a native of Tezcuco, son of a Spaniard, and grandson of Nezahualpitzintli, king of Tezcuco. His mother was the daughter of the said king and of an Indian slave.

The account that I shall give here will be concerned mainly with the cultivation and utilization of food plants drawn from the reprint of Pomar's treatise. His statements concerning the introduction of cultigens from other districts have proved to be highly significant.

Pomar wrote intelligently of the agricultural and economic systems of the people of Mexico in his day. He was another historian and panegyrist of Tezcuco, inferior certainly to Ixtlilxochitl, but older and more temperate. He was always in accord with what was Tezcucan, did not invent things of which he was ignorant, and wrote without exaggeration. He added certain details unnoted by Ixtlilxochitl, and untangled the twisted statements of other historians who described the kingdom and its people. He chose to leave the discussion of medicinal plants to Hernández, who came to Mexico in 1570.

If the assumption be correct that the Tezcucan population was composed of peoples of diverse origins who entered and settled in its borders, and where civilization was fostered by wise rulers, it is evident that any authentic record of its arts and industries is of major importance.

Tezcuco, the capital city, when at the apex of its development, had a population of 300,000 people who necessarily depended for their subsistence upon the labors of a larger number of rural subjects.

The kingdom of Tezcuco was situated east of the lake of the same name. The land sloped upward from the lake to the foot of the high mountains to the eastward and was traversed by numerous short rivers from which water was diverted by canals and ditches. Pomar described their water resources as follows:

> Large and voluminous rivers do not occur in this city or near it, because the arroyos of water which run to it are hardly able to reach the lake in the dry season. Morover, there was a necessity to unite and reduce into one many springs from their true sources, leading them from their courses and natural channels into conduits and canals which Nezahualcoyotzin and Nezahualpitzintli made, not solely for drinking water, but also for irrigating their orchards, gardens, and other property, and houses of pleasure. Now they also serve

[1] Received March 18, 1944.

[2] POMAR, J. B. *Relaciones de Tezcoco, 1582.* (Reprint, Salvador Chavez Hayhoe, Mexico, 1941).

to irrigate plantings of maize and wheat and on them the Spaniards have built mills for grinding and cloth making.

The water systems were not kept in repair after the subjugation of the country by the Spaniards because of the disruption of the kingdom.

Pomar's descriptions of agricultural plants are valuable additions to those given in a piece of picture writing made in 1530 by another Tezcucan scribe under the direction of a Spanish teacher which depicted plants supposedly typical of Cempoallan and other cities tributary to the kingdom of Aculhuacan.[3,4] The lists of agricultural plants differ somewhat, since Tezcuco lay at a higher altitude than Cempoallan.

The list of important, indigenous fruit crops shows that horticulture had reached an advanced stage of development among the Tezcucans. Pomar wrote:

> The cultivated lands give good crops of fine cherries, of excellent flavor, taste, and a reasonable livelihood. There are apple trees which give a fruit, yellow with a red blush, equal in size and flavor to that of Castille which we call San Juan. Some of these are better than others according to the culture which they give to the trees or to the quality of the soil in which they grow. The Indians dry apples and cherries and keep them for luxuries in winter. Apples of Castille, pears, and quinces may easily be grafted upon these apple trees. They have also blackberries. The avocados and white zapotes which they call "Sleepy Heads" are cultivated in this city in sheltered and warm locations, yet they are very small and inferior because they belong in the hot country.

He commented also upon oranges, peaches, pomegranates, and other European fruits cultivated in Tezcuco at the time he wrote.

The frequency with which the cactus *Opuntia tuna* Mill. was mentioned by Pomar and other early writers indicates that then, as now, it was an important food plant. The fruits were eaten either fresh or cooked. The sap pressed from the fleshy joints was administered to persons suffering from illnesses due to the heat. Practically every part of the plant had some particular use. He stated specifically that the plant was cultivated and described several of the principal varieties.

The agave was cultivated in pre-Columbian times, yielding many products of necessity and convenience. The saccharine sap was fermented to produce *pulque* or was evaporated to make a syrup which was an equivalent for sugar in their dietary. The leaves were a source of fiber, and of a tough paper. The people used the hot sap from agave leaves as a vulnary, an application not mentioned by other writers on pre-Columbian botany. Pomar said: "One of their principal plants is a kind of maguey which they call *Coxamalometl* with which they heal all sorts of wounds. They roast the fleshy leaves in hot embers and wash the wound with the hot sap from them and allay the convulsion (spasmo) by placing the leaf on the wound. So marvellous are its effects that they make cures which the medicos regard as miraculous."

Wine was made by fermenting these saps in wide-mouthed earthen jars which were kept loosely covered until the fermentation was finished. Wines from various sorts of agaves had their particular qualities, the inferior sorts being used only for cooking.

Maize, the all-important crop which furnished the principal supply of their carbohydrate food, was briefly mentioned by Pomar although omitted entirely by the unknown writer of the chronicle of Cempoallan.[3] Pomar gave no description of their methods of cultivation, to our great regret. Possibly he thought they were so well known as to require no mention in his communication to the king of Spain. Concerning other grains he wrote as follows: "The native grains, seeds, and culinary vegetables which have served, and still serve, the natives are first maize, then beans of different sorts and colors which, cooked with pepper, are the sustenance of the ordinary people, then the *chia* or sage (*Salvia* sp.) which is a small seed somewhat larger than the mustard, . . . of which the natives make a drink after roasting, grinding, and boiling it with water."

[3] Reed, H. S. *Ixtlilxochitl II and Cempoallan: A preliminary study of a Mexican picture-chronicle.* Hispanic Amer. Hist. Rev. 18: 66–75. 1938.

[4] Gomez de Orozco, Federico. *El codice de San Antonio Techialoyan. VI. "Codice de Cempoalla."* Anal. Mus. Nac. Arqueol., Hist., y Etnogr. (4)8: 311–332. 1933.

Huauhtli is the name of an important species of *Chenopodium* that was used as food by the ancient as well as the modern Mexicans. In his *Relaciones de Tezcoco* Pomar wrote: "Huauhtli is a seed like rape and of the same color, except it is a little flattened like lentils. After it is ground and kneaded they make firm loaves in maize leaves (husks?) which are cooked in ollas, or they make them into tortillas which are cooked on a comal. . . . They have michhuauhtli which is a smaller white seed of which they make loaves of bread like those of huauhtli and a beverage of the roasted and ground seeds dissolved in syrup." Emmart[5] interpreted michhuauhtli as "fish grain." The Aztecs made a poultice from its seeds for the treatment of siriasis, an inflammation of infants.

Pomar's mention of the uses of this plant was undoubtedly the first in any European language. Hernández[6] later described a medicinal plant of Mexico and gave it a name which suggests similarity but not identity with huauhtli. Thus: "We find in this New Spain many kinds of Atriplex agrestis which are universally called Hoautli or Hoahoautli and get great care in their gardens and orchards, such are Tlapal hoaquilitl or Tlapalhoauhtli." His description of the thick fibrous roots, red stem, and reddish flowers, however, suggests *Amaranthus* rather than *Chenopodium*.

Huauhtli was a cultivated plant, possibly not a native of Mexico, but modified by centuries of cultivation and selection. Its exact identity is not well established. From Mrs. Zelia Nuttall Safford obtained material which he described as a new species, *Chenopodium nuttalliae*,[7] stating that it has been cultivated from time immemorial by the Mexicans and that it is now unknown in the wild state. He said that the name Uauhtli, or Huauhtli, was applied by the Aztecs not only to the seeds, but to the plants as well; but when the plants were cooked for greens they were called Huauquilitl. Other botanists[8] have attempted to identify this plant as *C. quinoa*, which has been cultivated as a food plant by certain South American Indians since prehistoric times.[9]

I have had the opportunity of examining specimens lent by the Gray Herbarium of Harvard University which were collected by Dugès at Guanajuato. They are *Chenopodium album*, yet were said to be cultivated plants. The leaves are oval and somewhat decurrent; petioles as long as the laminae; seed-bearing heads quite compact. The label, apparently written by Dugès, contains the following important information: "Quelite cultivé. Sous le nom de Cuauzontle ou Cuauxoncle on mange les extremites fleuries, frites et envelopées d'oeuf. C'est un bien pauvre legume."

Another sheet of plants labeled "Quelite sauvage" which was also designated *C. album* by Dugès, contained smaller specimens whose slender stems bore loose heads, resembling plants often grown on barren soils.

The systematic relationships of *C. nuttalliae* are somewhat indefinite. In response to my inquiry, Dr. I. M. Johnston[10] wrote that the species seems to be very distinct from other undoubtedly native Mexican species of the genus, and concluded that it may well be a cultivated plant. There is every reason for distinguishing the plant called huauhtli from *C. album*, which is of European origin and would not therefore have a well-recognized Aztec name. Specimens of *C. nuttalliae* lent by the U. S. National Herbarium have no resemblance to other well-known North American species.

Dr. C. O. Sauer, of the University of California, has reported[11] that he saw a plant called huauhtli in Sinaloa. It therefore seems possible that the name may be applied to other edible species of *Chenopodium* in diverse parts of modern Mexico.

[5] EMMART, EMILY W. *The Badianus manuscript.* Baltimore, 1940.

[6] HERNÁNDEZ, FRANCISCO. *Rerum medicarum*, Liber VIII, 11, p. 269. Roma, 1651.

[7] SAFFORD, W. E. *Chenopodium nuttalliae, a food plant of the Aztecs.* JOURN. WASHINGTON ACAD. SCI. **8**: 521–527. 1918.

[8] AELLEN, P. *Beitrag zur Systematik der Chenopodium-Arten Amerikas.* Fedde Repert. Sp. Nov. **26**: 124. 1929.

[9] PARODI, L. *Relaciones de la agricultura prehispanica.* Anal. Acad. Nac. Agron. Vet. Buenos Aires. **1**: 115–167. 1935.

[10] JOHNSTON, I. M. Personal communication, 1943.

[11] SAUER, C. O. Personal communication, 1943.

There is evidence, therefore, that the plant which the Tezcucans called huauhtli had been brought into cultivation in pre-Colombian times and that the name may have been conferred also on *C. album* when it spread into Mexico from the Old World.

Although the Spaniards had introduced European pot-herbs, the natives preferred plants they had domesticated, some of which had been brought to Tezcuco from other localities.

Gourd fruits were cooked and eaten, and their seeds were added to many sorts of stews, to which they were said to impart an agreeable quality on account of their oil content. Pomar said that their gourds had the form and color of melons of Castille, though their rind was firmer. The chayote which bore fruits throughout the year was highly prized because of its flavor and keeping qualities. He wrote further of other vegetables:

> Tomatoes (and miltomatl) serve as spice with the peppers from which they make sauces and appetizers. These are different from any Spanish fruit. They will not be discussed further because they are well-known and they grow and yield in Spain . . . They have wild amaranth, watercress, tender onions, and purslane which they salt at the proper season. Peppers of many sorts and colors are eaten in all their food, fresh and dried, without which no food is acceptable to them.

The culture of European cereals on the estates of the Spaniards received the following comment from Pomar:

> Wheat and barley yield wonderfully on the farms and estates of the Spaniards, but very few Indians have space for them or for their proper sowing, being ordinarily occupied in the service of the Spaniards. They have harvested in Tezcuco and its surroundings as much as ten thousand fanegas of wheat, but very little barley, except what suffices for home use, because those who plant and harvest it do not sell it as they do wheat. Neither do they produce silk, although it would be possible for there are mulberry trees for feeding the worms. Formerly it was produced by D. Antonio Tlalhuitolzin, cacique and governor of the city, who was the son of Nezahualpitzintli.

He wrote briefly about tobacco, but did not state that it was cultivated in Tezcuco. The species which they knew was undoubtedly *Nicotiana rustica*. The name by which they knew it was Piçietl—the little fragrant tobacco—and it will appear from the following paragraph that tobacco was regarded as a medicinal plant by the majority of the Tezcucans:

> The herb which they call piçietl, which is said to be the same as that called henbane in Spain, is useful for sleep and for deadening the flesh and making the hard-worked body insensitive to fatigue. They take the ground dried leaves, wrap them around a little lime, and put a quantity such as would fill a hazelnut into the mouth between the lips and the gums when they go to sleep or to work. However, few of the Indians who are educated with Spaniards use it, neither the urban and polite gentry, only rustics and laborers. They also employ this herb for smoking in little reed tubes wrapped with liquidambar. They light the tips of the packed tubes and draw at the other end with the result, it is said, that they dry out the head and purge the rheum of the mouth. This is already admitted by the Spaniards who suffer these infirmities and use it as their remedy with benefit. They use it also for quotidian, tertian, and quartan fevers taking it as a suppository which purges them. Likewise the toasted leaves placed on the abdomen, when there is pain, cures them.

Omitting several other plants which Pomar mentioned as remedies, we may pause to read his lines about a plant known as ololiuhqui, since Hernández[12] also commented upon it. The name meant "Plant of the Serpents" and was synonymous with coaxihuitl.

"Ololiuhqui which is also brought from the hot country has a seed. When ground and made into a dough, it reduces swellings and drives away the pain. When ground and steeped in water and drank, it drives away weariness of the body because it causes sweating." Hernández said that the plant had cordate leaves and white flowers. His description and figure suggest that it might be a species of *Convolvulus*, but he said it had a rather long, rounded seed like coriander, hence the reference to serpents. Ramirez and Alcocer[13] identified the plant as *Ipomoea sidaefolia* Chois., and Safford noted (unpublished memorandum) that it grew in the Department of Monte Christo, Campeche, Yucatán.

His reference to another vegetable product is a bit difficult to interpret:

[12] Hernández, Francisco. *Rerum medicarum* Liber V, 14, p. 145. Roma, 1651.

[13] Ramirez, J., y Alcocer, G. V. *Sinonimia vulgar y científica de las plantas Mexicanas.* Mexico, 1902.

There is a little grana, not within the city but in the highlands like those between the city and the mountain and range of Tlaloc, which is somewhat more temperate and yet here the Indians give little to the city. Indeed, it may be that they have no time to attend to it because of their ordinary occupation which demands personal services to such an extent that they could not have time to harvest wheat and barley and to produce silk and grana.

Grana may mean the seed of a plant, but it can also mean scarlet grain, or cochineal, which the ancient Mexicans used so extensively for dyeing. According to Ximenez, the care and rearing of the coccids from which the dye was obtained was a recognized industry.

There is a sapient remark about the use of simples which must be mentioned before these notes are terminated. Those who have often perused the long dissertations about the real *and* fancied medicinal worth of many plants written by natives and Europeans in the sixteenth century will enjoy this soft sarcasm from Pomar's pen: "They have many roots for purging all sorts of humors and very good in the opinion of those who use them, except that they don't know how to apply them and they cure more or less by chance."

A study of his account of the botanical and agricultural topics relating to Texcucan civilization impresses one with his accurate, first-hand information on the subject, which should guide those who would search for plants worthy of wider utilization in our time.

ETHNOLOGY.—*Algonkian ethnohistory of the Carolina Sound.* MAURICE A. MOOK, American University.

(*Continued from page 194.*)

In some respects the best-known Carolina Algonkian group, at least the one with which the Roanoke colonists had the most numerous contacts, was the so-called Secotan. This tribe's domain extended from Albemarle Sound to lower Pamlico River and from Roanoke Island to the west-central region of present Beaufort County. Western Beaufort County and the river region above the present city of Washington, as will be seen, seem to have belonged to another tribe (the Poumouik). The northeastern section of the peninsula between the Pamlico and Neuse Rivers was also a part of Secotan territory. Secotan distribution thus included the present counties of Washington, Tyrrell, Dare, and Hyde, the greater part of Beaufort, and the northern part of Pamlico. The native inhabitants of the offshore islands were geographically, and perhaps also culturally and politically, closer to the Secotan than to any other Algonkian group.

Because of proximity to Roanoke the English colonists had closer contacts with the Secotan Indians than with any other tribe of the Carolina coast. Barlow's Wingandacoa is usually identified with Secotan (106), and most of the Indians whom he mentioned by name—Wingina, the chief, Granganimo, his brother, Wanchese and Manteo, the natives whom he took to England with him—were inhabitants of this area. Other persons and places referred to in his narrative are known by the relation of Secotan informants. Hariot stared that most of his ethnological information pertained particularly to the coastal area in the vicinity of Roanoke, and White's pictures of Indian scenes and subjects dealt largely with the towns of the Secotan tribe. He claimed that there were minor differences in native customs between towns in this territory, but such differences are to be expected among towns spread over an area as large as the one above indicated.

There is no information on the size of this group in 1586 (107), but that it was not the largest and strongest tribe of the region may be deduced from the facts of aboriginal history that are recorded in the narratives. For example, when Pemisapan (Wingina) planned his conspiracy against the English he called upon the northern tribes (Weapemeoc, Chowanoc, and Moratoc) for help and seems to have been but indifferently supported by the mass of his own people. Lane stated that the Chowanoc were the